Hilary M. Hurst

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CURRENT POSITION

Assistant Professor, Department of Physics & Astronomy, San José State University, San José, California

AREAS OF SPECIALIZATION

Physics; condensed matter theory: many-body quantum systems, quantum control, weak measurement, cold atomic gases, spin-orbit coupling, solitons.
Dissertation Title: Dynamics of Topological Defects in Hybrid Quantum Systems
Dissertation Advisor: Professor Victor Galitski

APPOINTMENTS HELD

Aug 2020 - *Assistant Professor*, San José State University, San José, California
2018-20 *NRC Postdoctoral Fellow*, National Institutes of Standards and Technology and Joint Quantum Institute, Gaithersburg, Maryland

EDUCATION

2018 PhD, Physics, University of Maryland
2013 MASt, Applied Mathematics and Theoretical Physics, University of Cambridge
2012 BSc, Engineering Physics, Minor: Public Affairs, Colorado School of Mines

GRANTS, HONORS, & AWARDS

2020 Quantum Leap Challenge Institutes - Conceptualization Grant, NSF
2018 National Research Council Postdoctoral Fellowship, NIST
2017 Outstanding Graduate Assistant, University of Maryland
2015 George A. Snow Memorial Award, University of Maryland Physics Department
2014 National Physical Sciences Consortium Graduate Research Fellowship, NSA/NPSC
2012 Physics Faculty Distinguished Graduate Award, Colorado School of Mines

2012 President's Senior Scholar-Athlete Award, Colorado School of Mines
2012 Summa Cum Laude, Colorado School of Mines
2010 Division II All-American, Track and Field Distance Medley Relay, NCAA

PUBLICATIONS & TALKS

Refereed Journal articles

2020 **Hurst, H. M.**, Guo, S., & Spielman, I. B. (2020). "Feedback Induced Magnetic Phases in Binary Bose-Einstein Condensates." Physical Review Research, 2, 043325.
2020 Flebus, B., Duine, R. A. & **Hurst, H. M.** (2020). "Non-Hermitian topology of one-dimensional spin-torque oscillator arrays." Physical Review B 102, 180408(R). [2]
2020 **Hurst, H. M.**, Galitski, V. & Heikkilä, T. T. (2020). "Electron Induced Massive Dynamics of Magnetic Domain Walls." *Physical Review B*, 101(5), 054407. [3]
2019 **Hurst, H. M.** & Spielman, I. B. (2019). "Measurement-induced dynamics and stabilization of spinor-condensate domain walls." *Physical Review A*, 99(5), 053612. [3]
2019 Shim, Y.-P., Ruskov, R., **Hurst, H. M.**, Tahan, C. (2019). "Induced quantum dot probe for material characterization." *Applied Physics Letters* 114, 152105. [3]
2017 **Hurst, H. M.**, Efimkin, D. K., Spielman, I. B., & Galitski, V. (2017). "Kinetic theory of dark solitons with tunable friction." *Physical Review A*, 95(5), 053604. [10]
2017 Aycock, L. M., **Hurst, H. M.**, Efimkin, D. K., Genkina, D., Lu, H. I., Galitski, V. , & Spielman, I. B. (2017). "Brownian motion of solitons in a Bose–Einstein condensate." *Proceedings of the National Academy of Sciences*, 114(10), 2503-2508. [36]
2016 **Hurst, H. M.**, Wilson, J. H., Pixley, J. H., Spielman, I. B., & Natu, S. S. (2016). "Real-space mean-field theory of a spin-1 Bose gas in synthetic dimensions." *Physical Review A*, 94(6), 063613. [13]
2016 **Hurst, H. M.**, Efimkin, D. K., & Galitski, V. (2016). "Transport of Dirac electrons in a random magnetic field in topological heterostructures." *Physical Review B*, 93(24), 245111. [4]
2015 **Hurst, H. M.**, Efimkin, D. K., Zang, J., & Galitski, V. (2015). "Charged skyrmions on the surface of a topological insulator." *Physical Review B*, 91(6), 060401(R). [30]

*[–] Indicates number of citations on Google Scholar

Non-Refereed Articles

2015 Hurst, H. M. (2015). "Women in Physics Hosts Career Panel." *APS Gazette*, 34(2), 3.
2013 Hurst, H. M. (2013). "New Perspectives on the Aharonov-Bohm Effect." *Part III Essay*. University of Cambridge.

Invited Presentations (Selected)

2020 *Quantum Control with Spinor Bose-Einstein Condensates*, Open Quantum Frontiers Workshop, Golden, CO.
2019 *Transport signatures of Dirac states in topological insulator - ferromagnet heterostructures*, KITP Seminar, Santa Barbara, CA.

2019 *Electron Induced Massive Dynamics of Magnetic Domain Walls*, University of Delaware Condensed Matter Seminar, Newark, DE.

2018 *What can weak measurements tell us about Bose-Einstein condensates?*, APS Mid-Atlantic Section Meeting, College Park, MD.

2018 *Transport signatures of Dirac electrons in a random magnetic field*, JQI Seminar, Joint Quantum Institute, College Park, MD.

2017 *Understanding dissipative dynamics of dark solitons: results from experiment and theory*, Gordon Research Seminar. Salve Regina University, Newport, RI.

2015 *Charged skyrmions on the surface of a topological insulator*, Workshop on Topological Spintronics and Skyrmionics. Institut Néel, Grenoble, France.

Contributed Presentations (Selected)

2020 *Quantum Control with Spinor Bose-Einstein Condensates*, APS DAMOP (Online).

2019 *Measurement induced dynamics and defect stabilization in spinor condensates*, APS March Meeting. Boston, MA.

2018 *Magnetic phases in a spinor Bose-Einstein condensate subject to weak measurement*, APS DAMOP Division Meeting. Ft. Lauderdale, FL.

2017 *Controllable friction of dark solitons in Bose-Fermi mixtures*, APS March Meeting. New Orleans, LA.

2016 *Transport signatures of Dirac electrons in a random magnetic field*, APS March Meeting. Baltimore, MD.

CONFERENCE & WORKSHOP ATTENDANCE (Selected)

2021 Jan AIP TEAM-UP Implementation Workshop, Virtual, Hosted by AIP.

2020 Dec National Quantum Initiative Community Meeting, Virtual, Hosted by DOE, NSF, & NIST.

2020 May APS DAMOP Division Meeting, (Virtual)

2020 Feb Open Quantum Frontiers Institute Workshop, Golden, CO.

2019 Nov KITP Program: Spin and Heat Transport in Quantum and Topological Materials, Santa Barbara, CA.

2019 Apr KITP Program: Open Quantum System Dynamics; Quantum Simulators and Simulations Far From Equilibrium, Santa Barbara, CA.

2019 Mar APS March Meeting, Boston, MA.

2018 May APS DAMOP Division Meeting, Ft. Lauderdale, FL.

2017 June NYU Center for Quantum Phenomena Inaugural Symposium, New York, NY.

2017 June Atomic Physics Gordon Research Conference: From Quantum Control to Tests of Fundamental Physics, Newport, RI.

2017 May SPICE Workshop: Non-Equilibrium Quantum Matter, Mainz, Germany.

2016 Oct KITP Program: Synthetic Quantum Matter, Santa Barbara, CA.

2015 Oct Workshop on Topological Spintronics and Skyrmionics, Grenoble, France.

2015 Aug Cargése Summer School: Strongly Correlated Materials with Spin-Orbit Coupling, Corsica, France.

TEACHING

San José State University

2020 Fall Quantum Mechanics (PHYS 163) - Primary Instructor

2020 Fall General Physics - Mechanics (PHYS 50) - Lab Instructor

University of Maryland, College Park

2017 Spr Non-relativistic Quantum Field Theory (PHYS625) - Guest Lecturer (2 lectures)

2013 Fall Physics for Biologists 1 (PHYS131) - Teaching Assisstant

RESEARCH

2018-20 *Postdoctoral Researcher*, Spielman Research Group, NIST/JQI
Weak measurement of many-body systems including numerical modeling of phase contrast imaging in spinor Bose-Einstein condensates. Creation and manipulation of novel many-body phases using measurement and feedback control.

2014-17 *Research Assistant*, Galitski Group
Condensed matter theory including spin-orbit coupling in atomic gases, topological insulators (TI) and interplay of TI surface states and unconventional magnetic textures such as skyrmions and magnetic vortices. Combination of analytical an numerical techniques including scattering theory, non-relativistic quantum field theory and simulations of Gross-Pitaevskii equations for Bose-Einstein condensates.

2016 Summer *Research Intern*, Laboratory for Physical Sciences
Noninvasive spectroscopy of Si/SiGe quantum wells. Development of new ways to measure valley splitting in Si/SiGe quantum wells using longitudinal coupling. Valley splitting determines the effectiveness of a Si/SiGe quantum well as a spin qubit.

2012 Spr *Senior Design Project*, Colorado School of Mines
Exploited the entanglement properties of quantum dots to perform simple logic functions. Computational quantum simulations in Mathematica were used to design a quantum dot molecule for uses in quantum computing.

2011 Summer *Undergraduate Research Intern*, Colorado Nanofabrication Lab
Fabrication and testing of GaAsBi/GaAs heterojunction bipolar transistors including photoresist spinning, etching, 4-point resistance measurements and e-beam lithography.

SERVICE

San José State University

2020- Reviewer, *Physical Review A, Physical Review Letters, Physical Review Research*

2020- Member, Organizing Committee, NSF Quantum Education Workshop

2020- Member, Physics & Astronomy Department Anti-Racism Committee

University of Maryland, College Park

2017- Reviewer, *Scientific Reports*
2017- Reviewer, *Annals of Physics*
2015-17 Physics Department Representative, *UMD Graduate Student Government*
2016 - Reviewer, *New Journal of Physics*
2014-15 Event Coordinator, *UMD Women in Physics*
2013-17 Mentor for Graduate *&* Undergraduate Mentoring programs, *UMD Women in Physics*

OTHER PROFESSIONAL QUALIFICATIONS

2017 *University Teaching and Learning Program Completion: Associate Level*, Teaching and Learning Transformation Center, University of Maryland
2016-18 *TS/SCI Cleared*. Most recent polygraph: February 25, 2016.

Programming Experience

Most experience with Python, Mathematica, and Julia
Some experience with MATLAB and Bash shell scripting

MEMBERSHIPS

2009- American Physical Society
2010 Sigma Pi Sigma (Physics Honor Society), year inducted.
2009 Tau Beta Pi Colorado Alpha Chapter (Engineering Honor Society), year inducted.
2008-12 Society of Women Engineers.